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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Gurtej Singh Sandhu et al.

Title: METHOD TO REDUCE FIXED CHARGE IN CVD OZONE DEPOSITED FILMS

Docket No.: 303.573US1

Serial No.: 08/636,069

Filed: April 22, 1996

Due Date: September 27, 2002

Examiner: Erik Kielin

Group Art Unit: 2813

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- ☒ A return postcard.
- ☒ Appellant's Brief on Appeal (amended) (26 Pages, in triplicate).

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)

Gurtej Singh Sandhu et al.)

Serial No.: 08/636,069)

Filed: April 22, 1996)

For: METHOD TO REDUCE)
FIXED CHARGE IN CVD)
OZONE DEPOSITED)
FILMS)

Examiner: Erik Kielin

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APPELLANT'S BRIEF ON APPEAL (AMENDED)

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Sir:

Appellant's Brief on Appeal

This Appeal Brief (Amended) is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on January 17, 2002, from the Final Rejection of claims 1, 2, 4-6, 31-36, 38-54 of the above-identified application, as set forth in the Final Office Action mailed November 30, 2001.

The original Appeal Brief was filed on March 18, 2002. In this Amended Appeal Brief, Section 7 entitled "GROUPING OF CLAIMS" has been amended to comply with 37 CFR 1.192(c)(7).

This Appeal Brief is filed in triplicate and accompanied by the requisite fee set forth in 37 C.F.R. § 117(f). Applicant respectfully requests reversal of the Examiner's rejection of pending claims 1, 2, 4-6, 31-36, 38-54.



APPELLANTS' BRIEF ON APPEAL

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1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee, Micron Technology, Inc., a Delaware corporation doing business at 8000 South Federal Way, P.O. Box 6, Boise, Idaho 83707-0006.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to the Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

Claims 1, 2, 4-6, 31-36, 38-54 are pending and the subject of the present appeal (see Appendix D). There are no other claims in the application.

4. STATUS OF AMENDMENTS

This application was originally filed on April 22, 1996, with claims 1-23.
Amendment and Response to first Office Action filed November 25, 1997.
Amendment and Response to final Office Action filed January 25, 1999.
Preliminary Amendment filed April 15, 1999 with CPA.
Amendment and Response to first Office Action after CPA filed September 7, 1999.
Preliminary Amendment and second CPA filed May 2, 2000.
Amendment and Response to first Office Action after second CPA filed November 30, 2000.
Amendment and Response to final Office Action after second CPA filed April 23, 2001.
Third CPA filed May 23, 2001.
Amendment and Response to first Office Action after third CPA filed September 27, 2001.

Final Office Action mailed November 30, 2001.

A Notice of Appeal was filed on January 17, 2002

5. SUMMARY OF THE INVENTION

The invention relates to integrated circuit manufacturing processes, and in particular relates to a process using ozone for the chemical vapor deposition of doped and undoped SiO₂ films. In general, the process includes the steps of disposing a substrate in a chemical vapor deposition chamber and exposing the substrate surface to a SiO₂ precursor gas, a carrier gas (e.g., one of the noble gases, nitrogen or hydrogen), and optionally a dopant gas in the presence of ozone. The process further includes exposing a reaction volume of gases above the substrate surface to a high intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films. The reactant gases in the reaction volume take part in heterogeneous chemical reactions. The novel process of the invention makes it possible to have a functional increase in available atomic oxygen at the substrate surface without increasing the ozone concentration in the gas chamber reaction volume in atmospheric pressure chemical vapor deposition (APCVD) applications.

6. ISSUES PRESENTED FOR REVIEW

(1) Were claims 1,2, 4-6, 31, 33-36, 38, 39-41, 43-44, 45-47, 48-49 and 50 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over JP2-050966 ("Hisamune") in view of U.S. Patent No. 5,00,133 to Wang et al. ("Wang")?

(2) Were claims 1,2, 4-6, 31, 33-36, 38, 39-41, 43-44, 45-47, 48-49 and 50 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over the article by Inoue et al., entitled "Growth of SiO₂ thin film by double-excitation photoinduced chemical vapor deposition incorporated with microwave excitation of oxygen," *Journal of Applied Physics* 64 (11), Dec. 1988 ("Inoue"), in view of Hisamune and Wang?

(3) Were claims 32, 51 and 52 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over either Hisamune and Inoue further in view of U.S. Patent No. 4,287,083 to McDowell et al. (“McDowell”)?

(4) Were claims 1, 2, 4-10, 41, 43-44, 45-47, 48-49 and 50 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamune in view of Wang and U.S. Patent No. 5,633,211 to Imai et al. (“Imai”) or alternatively, over Inoue in view of Hisamune, Wang and Imai?

7. GROUPING OF CLAIMS

The claims do not stand or fall together. Appellant suggests the following groups of claims, which are argued separately below.

Group I: 1, 2, 4-6, 31, 33-36, and 38-50

Group II: 32, 51 and 52

Group III: 1, 2, 4-10, 41, 43-44, 45-47, 48-49 and 50

Group IV: 53 and 54

Appellant does not make any admission that any claim may not be argued in another forum as independently patentable from any other claim.

8. ARGUMENT

A) The Applicable Law

“A patent may not be obtained...if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.” 35 U.S.C. § 103(a).

A determination of the obviousness or nonobviousness of claimed subject matter is a legal conclusion based on several factual inquiries. These include determining the scope and content of the prior art, ascertaining the differences between the prior art and the claims at issue, and resolving the level of ordinary skill in the pertinent art. *Graham v. John Deere Co.*, 148 USPQ 459, 467 (1966); *Winner International Royalty Corp. v. Wang*, 53 USPQ2d 1580, 1586 (Fed. Cir. 2000).

In ascertaining the differences between the prior art and the claims, courts are required to consider the claimed invention as a whole. *Panduit Corp. v. Dennison Mfg. Co.*, 1 USPQ2d 1593, 1597 (Fed. Cir. 1987). It is impermissible to use the claimed invention as a “template” to piece together the teachings of the prior art to render the claimed invention obvious. *In re Fritch*, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992). The claims must be interpreted in light of the specification, claim language, other claims, and prosecution history. *Panduit*, 1 USPQ2d at 1597. A §103 reference must also be considered in its entirety, “including portions that would lead away from the invention.” *Id.* A court must consider not only the similarities, but also the “critical differences between the claimed invention and the prior art.” *In re Bond*, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990).

In establishing obviousness, two or more references each containing elements of the claimed invention may be combined, provided all the recited claim elements are met and that there is a suggestion, teaching or motivation to combine the references. *In re Dembiczak*, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Further, even if the prior art provides such a suggestion, motivation or teaching, there must be a reasonable expectation of success for the suggested combination. *In re Vaeck*, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

Where inherency is relied upon to establish an element or characteristic of the claimed invention in a reference, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent element or characteristic necessarily flows from the teachings of the applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (B.P.A.I 1990); *Atlas Powder Co. v. Ireco, Inc.*, 51 USPQ2d 1943, 1946, 1947 (Fed. Cir. 1999) (emphasis added). A retrospective view of inherency is not a substitute for the required

teaching or motivation to combine references that supports the selection and use of the various elements in the references to arrive at the claimed invention. *In re Newell*, 13 USPQ2d 1248, 1250 (Fed. Cir. 1989). Further, the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed Cir. 1993). Moreover, that which may be inherent is not necessarily obvious because that which may be inherent may not be known, and obviousness cannot be predicated on what is unknown. *Id.* (citing *In re Spormann*, 150 USPQ 449, 452 (CCPA 1966)).

It has been held that claimed ranges near the prior art general conditions can render the claimed ranges *prima facie* obvious. *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996). However, this *prima facie* finding of obviousness can be rebutted if the applicant can make a showing of “unexpected results.” *In re Geisler*, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997). When claimed ranges are involved, the claimed range must achieve the unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). Under this standard, an unexpected result does not arise by discovery of optimum or workable ranges by routine experimentation. *In re Aller*, 105 USPQ 233, 235 (CCPA 1955).

B) The Office Action fails to make a *prima facie* case in rejecting claims 1, 2, 4-6, 31, 33-36 and 38-50 (Group I) for obviousness under 35 U.S.C. § 103(a) because there is no teaching or suggestion to combine Hisamune and Wang absent Appellant’s own disclosure, and even if combined the references fail to show all the elements of Appellant’s claimed invention.

At paragraph 2 of the Office Action, claims 1, 2, 4-6, 31, 33-36, and 38-50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamune in view of Wang.

Appellant respectfully submits that the Office Action fails to make a *prima facie* case of obviousness, as the combination of references fails to show all of the elements of Appellant’s

claims. Among other elements absent in the combination, these claims include the element in the processes thereof, that the reaction volume of gas is located above the substrate surface within a chemically reactive distance of the substrate, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume.

The Hisamune reference is used as the primary reference and combined with the other references to support the rejections of the claims. However, Hisamune and the other references not only fail to provide all the elements of the claimed invention, but also fail to provide a teaching or motivation to make the combinations cited by the Examiner.

All of Appellant's pending claims, i.e., claims 1-2, 4-6, 31-36 and 38-54, include the limitation that in the processes thereof, the substrate surface is heated to a temperature of at least 480C to about 700C, the reaction volume of gases is exposed to a high intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, and the reaction volume of gas is subjected to a pressure of approximately 200 to 760 Torr during deposition. Among other limitations absent in the cited combination of references, neither Hisamune nor any combination based thereon teaches or suggests a method as set forth in Appellant's claims including these limitations.

Appellant respectfully submits that it is entitled to rely on the positions taken by the Examiner at various times during the prosecution of the application. At page 6, the Office Action mailed August 30, 2000 states, "Hisamune is silent about pressures," a statement with which Appellant agrees. Appellant further agrees with the statement at page 2 (paragraph 2) of the Final Office Action mailed January 23, 2001 and at page 3, paragraph 2 of the Office Action mailed June 28, 2001 that Hisamune "does not (1) expressly teach a temperature range of 'at least 480C to 700C'; 2) specifically indicate a pressure range of 200 to 760 during deposition; or 3) specifically state in the Abstract that the functional atomic oxygen would be increased by the light source and thereby reduce the fixed charge in the oxide layer."

Appellant's claims also include the element in the processes thereof, that the reaction volume of gas is located above the substrate surface within a chemically reactive distance of the

substrate, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume. Appellant states in its disclosure at page 7, line 21-26, "The high intensity light source needs to be applied only to the reaction volume and can be supplied by an array of lamps arranged to give uniform illumination of said volume. It is not necessary to illuminate the gas volume in the rest of the CVD chamber or to illuminate the substrate surface. This process is different from photon-assisted CVD, where it is the substrate reaction surface on which photons are directed to increase reaction rates."

In addition to the other limitations absent in Hisamune, Appellant respectfully submits that it cannot find in Hisamune a teaching or suggestion of a reaction volume as set forth in these claims. Hisamune (in the translation thereof, see Patent Claim) refers only to "irradiating the inside of the reaction furnace with ultraviolet radiation to induce a photochemical reaction of the gaseous starting materials with ozone."

Further, Appellant's disclosure at page 7, lines 17-20 and the claims define the reaction volume "as taking part in heterogeneous chemical reactions, rather than the homogeneous reactions that take place in the gas volume in the rest of the chamber." Appellant respectfully submits that it cannot find in Hisamune or the cited combinations any teaching or suggestion of a reaction volume located within a chemically reactive distance of the substrate as set forth in the claims.

Regarding the combination of the Hisamune and Wang references, Appellant respectfully notes that Hisamune appears to be directed only to photo-CVD where Wang is directed only to thermal or plasma enhanced CVD, and etching. Appellant respectfully submits that Hisamune's designation of only photo-CVD teaches away from the use of other CVD processes in conjunction with its disclosure, just as Wang's designation of only thermal or plasma enhanced CVD processes teach away from the use of other CVD processes in conjunction with its disclosure.

Furthermore, Hisamune refers to its Table 1 to illuminate its favoring of a process disclosed therein producing a higher deposition rate and lower etching rate. Hisamune appears to

teach away from etching where Wang et al. (col. 5, lines 32-40 and 50-52; col. 22, lines 55-58 and 66-68) teach etching.

Appellant respectfully submits that there is no teaching or suggestion to combine these references absent Appellant's own disclosure. Accordingly, Appellant respectfully submits that the rejection of claims 1-2, 4-6, 31, 33-36, 38, 39-41, 42, 43-44, 45-47, and 50 is unsupported. Appellant thus respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a), and allowance of claims 1-2, 4-6, 31, 33-36, and 38-50.

C. Hisamune does not inherently disclose the elements in Appellant's claimed invention relating to "heterogeneous chemical reactions" and reducing the fixed charge

Appellant respectfully maintains that unless based on impermissible hindsight, the Examiner appears to be taking Official Notice of elements and teachings of Appellant's claimed invention that are missing in the cited prior art. In accordance with MPEP §2144.03, Appellant traverses the taking of Official Notice, and again requests that the Examiner cite a prior art reference in support of the assertion or submit an affidavit as required by 37 CFR 1.104(d)(2). Appellant notes that the Office Action now states "Given that Hisamune is clearly illuminating the reaction volume, it is held absent evidence to the contrary, that the reactants are inherently undergoing (1) 'heterogeneous chemical reactions', within a chemically reactive distance of the substrate, and (2) the fixed charge is necessarily reduced."

Appellant respectfully traverses this unsupported assertion. Appellant disagrees that Hisamune inherently shows heterogeneous chemical reactions within a chemically reactive distance of the substrate, or a reduction of fixed charge.

It is well established that for a prior art reference to inherently include a feature, that feature must be present in the reference by necessity. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (B.P.A.I 1990); *Atlas Powder Co. v. Ireco, Inc.*, 51 USPQ2d 1943, 1946, 1947 (Fed. Cir. 1999). Accordingly, if there is only a possibility that the feature is present in the reference, a finding of inherency as to that feature is improper. *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed Cir. 1993) (emphasis added). Appellant believes that the Office Action has improperly invoked inherency

based only on the possibility that Hisamune could include a heterogeneous chemical reaction within a chemically reactive distance of the substrate, or a reduction of fixed charge.

Unlike Appellant's claimed invention, there is no teaching in Hisamune of "exposing a reaction volume of gases located above the substrate surface within a chemically reactive distance of the substrate to a high intensity light source," with "the reactant gases in the reaction volume taking part in heterogeneous reactions, rather than homogeneous reactions." In fact, the Office Action uses a bootstrapping argument to find inherency by first presuming that the "the method as presently claimed is the same as disclosed in the applied art." This is a false presumption. There is simply not enough detail in Hisamune to allow the conclusion that Appellant's claimed invention necessarily occurs when practicing the invention in Hisamune.

D. Appellant's claimed temperature and pressure ranges are "unexpected" when the claims are properly viewed "as a whole."

The Office Action also states at page 4, lines 2-5, that "Appellant's specification indicates deposition parameters including a temperature range of 200-700C with a preferred of 480C and a pressure range of 0.1 to 760 Torr with 200 Torr preferred (specification, page 7) -- not the ranges now claimed: 480-700C and 200-760 Torr". The Office Action also concludes that the claimed temperature range is not "unexpected."

Appellant respectfully submits that the temperature and pressure ranges provided in the claims need to be viewed in the context of each claim as a whole. With respect to the claimed temperature range, Appellant submits that finding a similar or even overlapping temperature range in Hisamune is moot because the unexpected result is not the temperature range itself, but the result of performing the invention as claimed in that temperature range, namely that heterogeneous chemical reactions take place in the reaction volume to reduce the fixed charge in the deposited films.

The Office Action further contends regarding Appellant's claimed temperature and pressure range and claims 33-35 that "Wang et al. teach a similar TEOS/ozone process where helium is used as a carrier gas and a pressure range of about 10-200 Torr is taught (col. 20, lines

40-49)". Appellant notes, however, that at col. 21, lines 9-16, Wang et al. further state, "The thermal CVD process of the present invention uses unusually high deposition chamber pressures: pressures of preferably at least ≥ 10 torr and of about 20-200 torr are utilized. Even the lower portion of this range is over 20 times greater than the total pressure normally utilized in processes utilizing TEOS. The high pressure increases the density of available reactive species and, thus, provides a high deposition rate." Wang therefore teaches that one of ordinary skill in the art would, in processes utilizing TEOS, observe a total pressure of less than 1/20th of 20 torr, i.e. less than 1 torr. As the Wang reference must be considered for its antithetical teachings, the combination including Wang likewise teaches away from Appellant's claimed pressure range.

Furthermore, in view of the teachings of the cited combination which must be considered, Appellant's pressure range of approximately 200 to 760 torr is not taught by the cited combination, and would not be attempted absent the teachings of Appellant's disclosure. The pressure range as is relates to the result of the claimed invention, namely that heterogeneous chemical reactions take place in the reaction volume to reduce the fixed charge in the deposited films, is therefore unexpected.

E. The claim limitations relating to the parameters of pressure, temperature and ozone concentration are not obvious as "routine optimizations" when the claims are viewed as a whole.

Appellant respectfully traverses the Examiner's position that the optimization of the claim limitations relating to the parameters of temperature, pressure and ozone concentration is an obvious variant of the prior art.

Applicant respectfully submits that there must be some teaching in the prior art to suggest that the claimed parameters should be varied and that there is some motivation to do so. Appellant's specification suggests the temperature ranges and supports the reasons for such ranges. The prior art teaches away from a higher temperature range and there is no other reference to suggest that a higher temperature would bring the results suggested by the Examiner. The prior art teaches away from a higher pressure range and there is no reference to suggest that

an unusually high pressure as set forth in Appellant's claims would be attempted to achieve the results of the claimed invention. Thus, the combination lacks all elements of the claimed invention. The instant situation does not fall within the purview of the *Aller* and *Huang* cases cited in the Office Action. The general conditions of Appellant's claims are not disclosed in the prior art, as required by both *Aller* and *Huang*.

The Office Action on page 6 finds that the ozone concentrations provided in claim 36 is obvious as a routine optimization. This conclusion is based on the presumption that the resulting film is that taught by Hisamune. This is a false presumption. The film of Appellant's claimed invention has a reduced fix charge. Viewing dependent claim 36 as a whole requires reading the limitations in independent claim 31, which includes the limitation of reducing the fixed charge in the deposited film. Again, the "routine optimization" of the ozone concentration in view of Hisamune is misdirected because the result of Appellant's claimed invention is different from that of Hisamune. Stated in other terms, one would not be motivated to perform the "routine optimization" without first knowing the novel result of Appellant's claimed invention.

F. Claims 1, 2, 4-6, 31, 33-36 and 38-50 (Group I) are not clearly "anticipated" by Inoue in view of Hisamune and Wang because Inoue does not inherently disclose the claim limitation that the reactive gases undergo heterogeneous reactions

Claims 1, 2, 4-6, 31, 33-36, and 38-50 were rejected under 35 U.S.C. § 103(a) as being "anticipated" by Inoue in view of Hisamune and Wang. The Office Action states these claims are "clearly anticipated by Inoue in view of Hisamune and Wang," asserting that Inoue "clearly discloses each of the features of the instant invention" – but also states "Inoue does not teach Appellant's claimed temperature range, . . . pressure range or silicon source". The Office Action cites *In re Best* and *In re Fitzgerald* and takes the position that Inoue also inherently discloses reactant gases undergoing heterogeneous reaction as claimed by Appellant.

Appellant respectfully disagrees that Inoue inherently (i.e., necessarily) discloses performing heterogeneous chemical reactions within a chemically reactive distance of the substrate, or a reduction of fixed charge. All that can be said of Inoue is that UV light is directed

into the chamber to achieve the chemical reaction of decomposing O_3 to O_2 and oxygen atom radicals. It does not follow from this teaching or any other teaching in Inoue that Appellant's claim limitation relating to heterogenous reactions is necessarily present.

Appellant reincorporates the foregoing arguments made regarding the Application of Hisamune and Wang to these claims in response to the rejection set forth at paragraph 2 of the Office Action. Appellant respectfully submits that the rejection of claims 1-2, 4-6, 31, 33-36, 38, 39-41, 42, 43-44, 45-47, and 50 is unsupported. Appellant thus respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a), and allowance of claims 1-2, 4-6, 31, 33-36, and 38-50.

G. Claims 32, 51 and 52 (Group II) are not unpatentable over Hisamune and Inoue in view of Wang and McDowell because the combination of references fails to teach or suggest each and every element of the claims.

At paragraph 4 of the Office Action, claims 32, 51 and 52 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamune and Inoue as applied to claim 31 above, and further in view of U.S. Patent No. 4,287,083 to McDowell, et al. ("McDowell"). Appellant incorporates the arguments made hereinabove regarding Hisamune, Inoue, and any combination thereof. Appellant respectfully maintains that the combination of Hisamune, Inoue and McDowell is not proper. Appellant reincorporates previous arguments to that effect.

Even if the combination were proper, which Appellant does not admit, the combination fails to teach or suggest each and every element of Appellant's claims. Appellant cannot find in the combination of Hisamune, Inoue and McDowell, the processes stated in claims 32, 51 and 52. Among other limitations, Appellant cannot find in the combination a teaching or suggestion of a the stated process, wherein a reaction volume is subjected to a pressure of approximately 200 to 760 Torr during deposition. Further, Appellant cannot find in the combination a teaching or suggestion of the stated process including heating a substrate to a range of at least 480C to about 700C. In fact, the only reference to temperature in McDowell is a teaching of maintaining a

reaction temperature of below 40C (Example I), and storing the resulting reaction product of the free radical polymerization reaction described therein at 60C (Example XVIII).

Accordingly, withdrawal of the stated rejection is respectfully requested, in addition to allowance of claims 32, 51 and 52.

H. Claims 1,2, 4-10, 41, 43-44, 45-47 and 50 (Group III) are not unpatentable over Inoue and/or Hisamune in view of Wang and Imai because combining Imai with Hisamune is improper

At paragraph 5 (page 9) of the Office Action, claims 1, 2, 4-10, 41, 43-44, 45-47, 48-49 and 50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamune, Wang and U.S. Patent No. 5,633,211 to Imai et al. ("Imai"), or alternatively, over Inoue in view of Hisamune, Wang and Imai. Appellant incorporates all of the foregoing arguments regarding Inoue and Hisamune and any combination thereon, and arguments regarding the combination of the Inoue, Hisamune and Wang references.

Appellant notes further that Imai issued May 27, 1997, claiming an effective U.S. filing date of March 26, 1993. Since Imai issued after the filing date of the present application (i.e., April 22, 1996), Imai may be properly defined as a reference under 35 U.S.C. § 102(e). Since Imai et al. may be a reference defined under 35 U.S.C. § 102(e), it is a removable reference if Appellant proves a date of invention predating March 26, 1993 (the effective filing date of the Imai et al. patent). Appellant respectfully reserves the right to file a Petition under 37 C.F.R. § 1.131 to swear behind Imai. However, because Appellant deems Imai to be distinguishable from the instant claims, Appellant at this time does not choose to remove Imai as a reference, but reserves exercising this right for a later date.

It is noted that to support a rejection based upon a combination of references there must be some "teaching, suggestion, or reason" to combine references. The absence of such is dispositive in an obvious determination. *Winner International Royalty Corporation v. Wang*, 53 USPQ2d, 1580, 1586 (Fed. Cir. 2000) (citing *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997)).

Appellant respectfully submits that it is improper to combine Imai with Hisamune or any combination based thereon. It is apparent from Hisamune that photo-CVD was understood in the art at the time of the earliest priority date claimed by Imai et al. *See* Translation of Hisamune, page 2, lines 7-13; Imai, Front Page, section 30. Yet Imai specifically recites conventional CVD in conjunction with the source compounds relied upon by the rejection. Imai, column 1, lines 42-46 and Table. Given Imai's specific designation of conventional CVD for use with the source compounds, Appellant respectfully submits that there is no motivation to combine Imai with Hisamune and its photo-CVD process. Appellant further respectfully maintains that Imai's designation of conventional CVD teaches away from the use of other CVD processes in conjunction with its disclosure.

Accordingly, Appellant respectfully submits that it is improper to combine the references in a manner necessary to support rejection of claims 1, 2, 4-6, 41, 43-44, 45-47, 48-49 and 50. Appellant respectfully submits that there is no teaching or suggestion to combine the references absent Appellant's own disclosure. Appellant respectfully submits that the rejection of claims 1, 2, 4-6, 41, 43-44, 45-47, 48-49 and 50 is unsupported. Appellant thus respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a), and allowance of claims 1, 2, 4-6, 41, 43-44, 45-47, 48-49 and 50.

I. Claims 53 and 54 (Group IV) are not unpatentable over Hisamune in view of Wang and Imai, or alternatively over Inoue in view of Hisamune, Wang and Imai, further in view of McDowell for the reasons set forth above.

Claims 53 and 54 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamune in view of Wang and Imai or, alternatively, Inoue in view of Hisamune, Wang and Imai as applied to claim 52 above, and further in view of McDowell. Appellant incorporates all of the foregoing arguments regarding Inoue and Hisamune and any combination thereon, and arguments regarding the combination of the Inoue, Hisamune, Wang and McDowell references.

Appellant thus respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a), and allowance of claims 53 and 54.

9. SUMMARY

For the foregoing reasons, the Appellant respectfully submits that the rejections of claims 1, 2, 4-6, 31-36, 38-54 under 35 U.S.C. § 103(a) were erroneous. Reversal of the rejections is respectfully requested, as well as the allowance of all the claims.

A check in the amount of \$320.00 was already sent with the original Brief. Please charge any additional fees to Deposit Account 19-0743.

Respectfully submitted,

Gurej Singh Sandhu et al.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

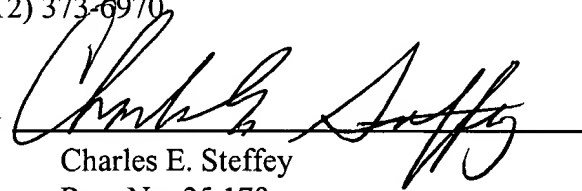
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APPENDIX I

The Claims on Appeal

1. A chemical vapor deposition (CVD) process for depositing borophosphosilicate glass films on a substrate surface, the process comprising:
 - disposing the substrate within a chemical vapor deposition reaction chamber;
 - heating the substrate to a temperature within a range of at least 480°C to about 700°C;
 - introducing a gas volume of SiO₂ precursors into the chamber;
 - admitting a gas volume of ozone into the chamber;
 - admitting a dopant source for phosphorus into the chamber;
 - admitting a dopant source for boron into the chamber; and
 - exposing a reaction volume of gases located above the substrate surface within a chemically reactive distance of the substrate to a high intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and
 - subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the borophosphosilicate layer.
2. The method of Claim 1, wherein the SiO₂ precursor is selected from the group consisting of TEOS (tetraethylorthosilicate), TMCTS (tetramethylcyclotetrasiloxane), DES (diethylsilane), DTBS (ditertiarybutylsilane), TMOS (tetramethylorthosilicate) and FTES (fluorotriethoxysilane).

4. The method of Claim 1, wherein the dopant source for boron is selected from the group consisting of triisopropylborate, TMB (trimethylborate), and TEB (triethylborate), and the dopant source for phosphorus is selected from the group consisting of TEPO (triethylphosphate), TEPI (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite).

5. The method of Claim 1, further comprising introducing a gas volume of a carrier gas into the reaction chamber.

6. The method of Claim 5, wherein the dopant source for boron is selected from the group consisting of triisopropylborate, TMB (trimethylborate) and TEB (triethylborate), and the dopant source for phosphorus is selected from the group consisting of TEPO (triethylphosphate), TEPI (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite).

31. A method of depositing a silicon dioxide layer on a substrate surface, the method comprising:

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor and ozone;

heating the substrate surface to a temperature of at least 480°C to about 700°C ; and

illuminating the reaction volume of gas from a light source without directly exposing the substrate surface to the light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than in homogeneous reactions taking place in the chamber outside of the reaction volume, subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

32. The method of Claim 31, wherein the light source comprises mercury arc vapor lamps.

33. The method of Claim 31, wherein the reaction volume of gas further comprises a carrier gas.
34. The method of Claim 31, wherein the reaction volume of gas further comprises a carrier gas selected from the group consisting of the Noble gases, nitrogen and hydrogen.
35. The method of Claim 31, wherein the reaction volume of gas further comprises a carrier gas comprising helium.
36. The method of Claim 31, wherein ozone comprises approximately 5% to 15% by volume of the reaction volume of gas.
38. The method of Claim 31, further comprising:
subjecting the reaction volume of gas to a pressure of approximately 200 torr during deposition of the silicon dioxide layer.
39. The method of Claim 31, wherein the SiO_2 precursor is selected from the group consisting of TEOS (tetraethylorthosilicate), TMCTS (tetramethylcyclotetrasiloxane), DES (diethylsilane), DTBS (ditertiarybutylsilane), TMOS (tetramethylorthosilicate) and FTES (fluorotriethoxysilane).
40. The method of Claim 31, wherein the reaction volume of gas further comprises at least one dopant source selected from the group consisting of triisopropylborate, TMB (trimethylborate), TEB (triethylborate), TEPO (triethylphosphate), TEPi (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite).

41. The method of Claim 31, wherein the reaction volume of gas further comprises at least one dopant source for boron selected from the group consisting of triisopropylborate, TMB (trimethylborate), and TEB (triethylborate), and at least one dopant source for phosphorus selected from the group consisting of TEPO (triethylphosphate), TEPi (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite).

42. A method of depositing a doped silicon dioxide layer on a substrate surface, the method comprising:

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor, ozone and at least one dopant source;

heating the substrate surface to a temperature of at least 480°C to about 700°C ; and

illuminating the reaction volume of gas from a light source without directly exposing the substrate surface to the light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

43. A method of depositing a doped silicon dioxide layer on a substrate surface, comprising: contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor, ozone and at least two dopant sources; heating the substrate surface to a temperature of at least 480°C to about 700°C ; and illuminating the reaction volume of gas from a light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the

reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

44. The method of Claim 43, wherein the at least two dopant sources comprise a dopant source for boron and a dopant source for phosphorus.

45. A method of depositing a borophosphosilicate glass layer on a substrate surface, comprising:

heating the substrate surface to a temperature of at least 480°C to about 700°C;

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, wherein the reaction volume of gas comprises:

a SiO₂ precursor selected from the group consisting of TEOS

(tetraethylorthosilicate), TMCTS (tetramethylcyclotetrasiloxane), DES (diethylsilane), DTBS (ditertiarybutylsilane) and TMOS (tetramethylorthosilicate);

a dopant source for boron selected from the group consisting of triisopropylborate, TMB (trimethylborate), and TEB (triethylborate); and

a dopant source for phosphorus selected from the group consisting of TEPO (triethylphosphate), TEPi (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite);

illuminating the reaction volume of gas from a high intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume

taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and
subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

46. A method of depositing a fluorosilicate glass layer on a substrate surface, comprising:
heating the substrate surface to a temperature of at least 480°C to about 700°C;
contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a fluorinated SiO₂ precursor and ozone; and
illuminating the reaction volume of gas from a light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume take part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and
subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the fluorosilicate layer.

47. A method of depositing a doped fluorosilicate glass layer on a substrate surface, the method comprising:
heating the substrate surface to a temperature of at least 480°C to about 700°C;
contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a fluorinated SiO₂ precursor, ozone and at least one dopant source; and
illuminating the reaction volume of gas from a light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions,

rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

48. A method of depositing a doped fluorosilicate glass layer on a substrate surface, the method comprising:

heating the substrate surface to a temperature of at least 480°C to about 700°C;

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a fluorinated SiO₂ precursor, ozone and at least two dopant sources; and

illuminating the reaction volume of gas from a high-intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the fluorosilicate layer.

49. The method of Claim 48, wherein the at least two dopant sources comprise a dopant source for boron and a dopant source for phosphorus.

50. A method of depositing a fluoroborophosphosilicate glass layer on a substrate surface, the method comprising:

heating the substrate surface to a temperature of at least 480°C to about 700°C;

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, wherein the reaction volume of gas comprises:

a SiO_2 precursor comprising FTES (fluorotriethoxysilane);

a dopant source for boron selected from the group consisting of triisopropylborate, TMB (trimethylborate), and TEB (triethylborate); and

a dopant source for phosphorus selected from the group consisting of TEPO (triethylphosphate), TEPi (triethylphosphite), TMPo (trimethylphosphate) and TMPi (trimethylphosphite); and

illuminating the reaction volume of gas from a high intensity light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the fluoroborophosphosilicate layer.

51. A method of depositing a silicon dioxide layer on a substrate surface, the method comprising:

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor and ozone;

heating the substrate surface to a temperature of at least 480°C to about 700°C ; and

illuminating the reaction volume of gas from a light source comprising mercury arc vapor lamps without directly exposing the substrate surface to the light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and

subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

52. A method of depositing a doped silicon dioxide layer on a substrate surface, the method comprising:

contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor, ozone and at least one dopant source; heating the substrate surface to a temperature of at least 480°C to about 700°C ; and illuminating the reaction volume of gas from a light source comprising mercury arc vapor lamps without directly exposing the substrate surface to the light source to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

53. A method of depositing a doped silicon dioxide layer on a substrate surface, the method comprising:

heating the substrate surface to a temperature of at least 480°C to about 700°C ; contacting the substrate surface with a reaction volume of gas located above the substrate surface within a chemically reactive distance of the substrate, the reaction volume of gas comprising a SiO_2 precursor, ozone and at least two dopant sources; and illuminating the reaction volume of gas from a light source comprising mercury arc vapor lamps to increase the functional atomic oxygen concentration and reduce the fixed charge in the deposited films, the reactant gases in the reaction volume taking part

in heterogeneous chemical reactions, rather than homogeneous reactions taking place in the chamber outside of the reaction volume; and
subjecting the reaction volume of gas to a pressure of approximately 200 to 760 torr during deposition of the silicon dioxide layer.

54. The method of Claim 53, wherein the at least two dopant sources comprise a dopant source for boron and a dopant source for phosphorus.

APPENDIX II

Cited Statutes, Rules, and Case law

I. Statutes and Rules

- 35 U.S.C. § 103(a)

II. Case law

- *Graham v. John Deere Co.*, 148 USPQ 459, 467 (1966).
- *Winner International Royalty Corp. v. Wang*, 53 USPQ2d 1580, 1586 (Fed. Cir. 2000).
- *Panduit Corp. v. Dennison Mfg. Co.*, 1 USPQ2d 1593, 1597 (Fed. Cir. 1987).
- *In re Fritch*, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992).
- *In re Bond*, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990).
- *In re Dembiczak*, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999).
- *In re Vaeck*, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).
- *Ex parte Levy*, 17 USPQ2d 1461, 1464 (B.P.A.I 1990).
- *Atlas Powder Co. v. Ireco, Inc.*, 51 USPQ2d 1943, 1946, 1947 (Fed. Cir. 1999).
- *In re Newell*, 13 USPQ2d 1248, 1250 (Fed. Cir. 1989).
- *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed Cir. 1993).
- *In re Geisler*, 43 USPQ2d 1362 (Fed. Cir. 1997).
- *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).
- *In re Aller*, 105 USPQ 233, 235 (CCPA 1955).
- *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996).
- *In re Best*, 195 USPQ 430, 433 (CCPA 1977).
- *In re Swinhart*, 169 USPQ 226, 229 (CCPA 1971).
- *In re Fitzgerald*, 205 USPQ 594 (CCPA 1980).